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representatives, in natural size and also much enlarged, of the seeds of 100 of the most troublesome species. These illustrations are from the water-color sketches of NORMAN CRIDDLE, and will enable the farmer to identify readily most of his plant enemies, either while they are growing in the field or while polluting his seed grain.

The book is well printed and strongly bound, which, together with its other admirable qualities, makes it a valuable addition to the literature of economic botany.—GEO. D. FULLER.

A text-book of pharmacognosy.—A fourth edition of KRAEMER'S *Text-book* has appeared.[3] It is "intended for the use of students of pharmacy, as a reference book for pharmacists, and as a handbook for food and drug analysts." Such a statement indicates that the volume does not fall within the province of a botanist for review, and yet the material presented is of great interest to botanists. Part I (pp. 222) is entitled "Botany," and comprises a presentation of all the great groups, "outer morphology of angiosperms," "inner morphology of the higher plants," "classification of angiosperms yielding vegetable drugs," and "cultivation of medicinal plants." Of course this is botany for the pharmacist, and Dr. KRAEMER is in a position to know what the pharmacist needs. Only the first chapter, dealing with the great groups, really pertains to the non-pharmaceutical botanist. Perhaps it makes no difference to the students concerned, but the very antique flavor of the presentation of the great groups is somewhat surprising to the modern morphologist. Part II (pp. 383) is entitled "Pharmacognosy," and deals first with crude drugs, and then with powdered drugs and foods. Part III (pp. 88) is entitled "Reagents and technique"; and part IV (pp. 38) deals with "Micro-analysis."

The volume is certainly a thesaurus of information for the pharmacist, and doubtless will have great influence upon the progress of pharmacognosy in this country. There is abundant evidence, also, of an immense amount of painstaking labor on the part of the author, who is to be commended for his many years of faithful effort to organize and advance his subject.—J. M. C.

A naturalist in the Bahamas.—Under this title a memorial volume in honor of Dr. JOHN I. NORTHROP has appeared.[4] The botanical papers are as follows: "Flora of New Providence and Andros (Bahama Islands)," by ALICE R. NORTHROP (reprinted from Mem. Torr. Bot. Club **12**:no. 1. 1902); "Plant notes from Temiscouata County, Canada," by JOHN I. and ALICE R. NORTHROP (reprinted from Bull. Torr. Bot. Club **17**:1890); "Notes on the plant distribution of Mt. Washington, N.H.," by JOHN I. and ALICE R. NORTHROP; and

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[3] KRAEMER, HENRY, A text-book of botany and pharmacognosy. pp. viii+888. Philadelphia and London: J. B. Lippincott Company. 1910. $5.00.

[4] A naturalist in the Bahamas. JOHN I. NORTHROP. Oct. 12, 1861—June 25, 1891. A memorial volume edited with a biographical introduction by HENRY FAIRFIELD OSBORN. pp. 281. New York: The Columbia University Press. 1910. $2.50.

"A study of the histology of the stem of the wax plant, *Hoya carnosa* (L.) R. Br.," by JOHN I. NORTHROP.—J. M. C.

NOTES FOR STUDENTS

Prothallia of Lycopodium.—BRUCHMANN[5] has completed the life histories of *L. clavatum*, *L. annotinum*, and *L. Selago*, with an account of the growth of the prothallia from the germination of the spores to the maturing of the sex organs, and with the study of the embryo development of *L. Selago*. Previously the germination of only three species was known, all with a prothallium containing chlorophyll and belonging to the *cernuum* type: *L. salakense*, independent in development and free from a fungus; *L. cernuum;* and *L. inundatum*, dependent for complete development upon an endophytic fungus.

The germination of the spores was secured by sowing them in the forest where they were found. This was done in two ways: (1) by putting spores and species of fresh strobili into flower pots in potting soil (peat, leaf mold, manure, sand) and forest soil and sinking them in the ground; and (2) by mixing spores with forest soil and burying them in holes 10 cm. deep. The germination of *L. Selago* occurred in 3–5 years after sowing; that of *L. clavatum* and *L. annotinum* in 6–7 years. Prothallia bearing mature sex organs appeared first in *L. Selago* 6–8 years after sowing; in *L. clavatum* and *L. annotinum* in 12–15 years. Practically all the spores of a sporangium of *L. Selago* germinated, but only about 5 per cent of those of other species. All three species develop independently a five-celled chlorophyllose prothallium, after which a fungus is necessary to complete the development. *L. clavatum* and *L. annotinum* develop in the same way, while *L. Selago* forms a type by itself.

The first division, an irregular one, cuts off a small lens-shaped cell at the base of the spore. Although containing food substances, it is poor in cytoplasm and never enlarges. BRUCHMANN considers it a rudimentary rhizoidal cell, homologous with the first rhizoid of the true ferns. The second division, occurring after the spore coat bursts, extends an oblique wall from base to apex, bent toward the rhizoidal cell. While in the *clavatum* type this wall divides the prothallium into hemispheres, in the *Selago* type it is sharply bent away from the rhizoidal cell, making the resultant cells unequal. The difference in direction determines the type of prothallium. The basal cell next to the rhizoidal cell never divides. Its sister cell cuts off an inner wedge-shaped cell and an outer apical cell. A fourth wall divides the wedge into an outer peripheral and an inner or central cell. In *L. Selago* the wedge-shaped cell is considered the first segment cut off from the apical cell.

From this point BRUCHMANN divides the growth of the prothallia into three periods, depending upon change in direction and manner of growth.

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[5] BRUCHMANN, H., Die Keimung der Sporen und die Entwicklung der Prothallien von *Lycopodium clavatum*, *L. annotinum*, und *L. Selago*. Flora **101**:220–267. *figs. 35*. 1910.